

## **TITLE**

The National Aeronautics and Space Administration's Earth Science Applications Program:  
Exploring Partnerships to Enhance Decision Making in Public Health Practice

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**SYNOPSIS:**

The National Aeronautics and Space Administration (NASA), Earth Science Enterprise is engaged in applications of NASA Earth science and remote sensing technologies for public health. Efforts are focused on establishing partnerships with those agencies and organizations that have responsibility for protecting the Nation's health. The program's goal is the integration of NASA's advanced data and technology for enhanced decision support in the areas of disease surveillance and environmental health. A focused applications program, based on understanding partner issues and requirements, has the potential to significantly contribute to more informed decision making in public health practice. This paper intends to provide background information on NASA's investment in public health and is a call for partnership with the larger practice community.

## **THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AND PUBLIC HEALTH COMMUNITY: HISTORIC COLLABORATIONS AND SUCCESSES**

*These are extraordinary times. And we face an extraordinary challenge. Our strength as well as our convictions have imposed upon this nation the role of leader in freedom's cause - John F. Kennedy*

President John F. Kennedy made these opening remarks during his historic address to Congress on May 25, 1961.<sup>1</sup> Over forty years later we find these words still hold meaning for us, both in a historic sense and within the context of the modern times in which we all live.

This speech not only compelled the Nation to consider manned space flight, particularly in light of the Soviet Union's Sputnik success in 1957, but focused the activity to a single and monumental goal: landing a man on the moon and returning him safely to Earth.

As we think about our extraordinary times we wonder, what defines our extraordinary challenge? We embarked on our journey into a new millennium. We are witness to an era of continued political stress and instability, global economic vulnerability and terrorist threat, extreme poverty and oppression in many parts of the world, significant local, regional and global health challenges and ever increasing pressures worldwide on finite resources and the environment.

### **EARLY PARTNERSHIPS**

When President Kennedy asked the American public to bear the burden of reaching the moon he also challenged the scientific community to work together:

*[This decision demands] a degree of dedication, organization and discipline which have not always characterized our research and development efforts.<sup>2</sup>*

Again, these words hold meaning in our modern reality. It seems our extraordinary challenge is not defined by a single problem but rather by our collective success in building partnerships that are driven to problem solving solutions.

With the successful landing of Apollo 11 in July of 1969, the Nation's strong support of a civil space program, managed by the newly formed National Aeronautics and Space Administration (NASA), proved successful in achieving the remarkable goal of sending humanity to the moon and back. This scientific and technological feat could not have been accomplished without a clear vision, mission and the full support and contributions from countless individuals, agencies, institutions, and industry partnerships.

NASA's relationship with the public health community, specifically the U.S. Public Health Service, dates to the 1960s Apollo-era when the Space Science Board and Public Health Service first raised concerns over the potential importation of alien micro organisms from lunar rock and soil samples, and the risk of back contamination posed by astronauts exposed to the lunar surface, returning to Earth.<sup>3</sup> In 1965, NASA's Deputy Administrator, Hugh Dryden and U.S. Surgeon General, William Stewart formally established a liaison office and advisory committee to develop and manage the Apollo biological containment and quarantine program.<sup>4</sup>

### **THE CHALLENGE: A NEW ERA OF COOPERATION**

Today, the many new and urgent issues facing our country once again challenge the research and development community to dedicate themselves to work together. NASA seeks to cultivate strong partnerships and substantive collaborations that lead to the measurable mitigation of National priority problems. As NASA continues the enterprise to explore Space

there is another enterprise devoted to understanding planet Earth. NASA is the lead research and development agency for Earth system science and remote sensing (the observation of an object or phenomenon from a distant vantage point). The Department of Health and Human Services is the lead agency responsible for protecting the health of all Americans. Are there opportunities to collaborate once again to address National priorities? We ask the public health community to consider the application of NASA's advanced Earth science and technology to critical issues facing the public health community.

### **NASA OFFERINGS**

NASA's mission and vision to understand and protect our home planet and improve life here, as only NASA can, opens up new areas of opportunity. NASA's Earth Science Enterprise (ESE) is charged with developing a scientific understanding of the Earth system and its response to natural and human-induced changes. NASA's Earth science research program is designed to characterize the Earth's system of land surface, solid earth, atmosphere, biosphere, cryosphere, and oceans; understand the forcing processes and interactions between Earth's system components; and better predict global climate variability, weather, and natural hazards.<sup>5</sup>

NASA's Earth Science is enabled by the development of exploratory and systematic satellite and airborne Earth observing remote sensing missions designed to collect measurements of the Earth system. These measurement data feed model development, and these models are employed to answer questions of prediction. NASA's long-term Earth system science impacts and successes are dependent on these data and models generating information and scenarios that are accepted by the global scientific community, adopted by global, national, and local policy makers and used to support global, regional, and local policy decisions.

### **NASA AND PUBLIC HEALTH: PRIORITY APPLICATIONS**

NASA's interest in public health is directly related to NASA's Earth science questions, measurements and models. The epidemiology of disease is, in many instances, a function of specific environmental conditions that support disease propagation to human hosts, and the complex relationships between humans and their natural and cultural environments. Wetness, soil moisture, vegetation (biomass), surface temperature, aerosol transport, population distribution, and densities are just a few of the many variables that define the parameters of disease propagation. To the extent the etiology of specific diseases is linked to the environment and is observable in a spatial and temporal context, it is not unreasonable to believe advanced Earth system science results and remote sensing tools will be useful.

NASA's Public Health Applications Program recognizes that successful applications of remote sensing to public health practice requires NASA to first understand the priority issues facing the public health community. Only then, and only through partnerships, can we effectively evaluate the potential for addressing critical public health issues with Earth system science and remote sensing technologies. NASA must also baseline the current capabilities and "readiness" of public health practitioners to integrate new technologies, data and information into daily practice and identify criteria by which technology tools, data products and decision support systems can be benchmarked for quality and efficiency.

The utility of data and data products derived from NASA sensor systems for public health practice and decision support is not proven. However, the data, information products and modeling capabilities hold promise when considered in the context of the potential to scale global and continental climate variability, landscape epidemiology, pathogen and toxin transport information and a host of derivative environmental models to dimensions useful for regional and local public health practitioners.

## **FORGING THE FUTURE**

NASA missions, measurements, predictive models, and other resultant products will certainly help global, national and local public health communities understand relationships between climate, ecology and deadly disease occurrences. However, the key to public health applications will be the successful translation of Earth science knowledge and understanding to decisions that prevent, contain, treat and mitigate adverse disease outcomes in affected or potentially affected populations. The public health community is the only entity that can translate health priorities for NASA. NASA's learning curve is steep and this translation will likely involve a thorough understanding of the social and political structure and cultural norms associated with public health delivery at national, regional and local levels. It will also require remote sensing requirements research that is cognizant of existing geographic information system and modeling capabilities within the public health community; consideration of multiple sources of remotely sensed data and consideration of new and emerging technologies. NASA success in public health applications is entirely dependent on the public health community's desire to enter into collaborations with NASA.

The challenges and complexities inherent in any human and technology integration do not outweigh the effort. NASA welcomes the opportunity to engage the organizations that comprise the Department of Health and Human Services, schools of public health and other members of the greater public health practice community in focused discussions on citizen centered and solution driven decision support.

By working collaboratively, we can identify areas of opportunity to enlist and integrate new and powerful science discoveries and remote sensing tools in the battle to survey, contain and mitigate a variety of diseases and preserve environmental health.

For more information on NASA's Public Health Applications Program please contact:

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